Management of Sunflower Insect Pests

Rules For Sound Insect Management

1. Accurately identify the pest and properly interpret the situation. Ask your county agricultural extension agent for help if you have questions. Best management often differs from species to species and among situations.
2. Proper timing of control measures cannot be overstressed. Detect the problem before the damage reaches an advanced stage (scout each field at least weekly).
3. Realize that preventing all insect damage should not be your objective. Treatments are seldom justified unless expected losses equal or exceed the cost of control.
4. In some situations pest problems can be prevented or alleviated without the use of insecticides.

How to Use This Guide

This publication was prepared to help producers manage insect populations with methods effective under Kansas conditions. It is revised as funds become available, check labels for latest product use information.

Except where otherwise indicated the insecticides listed are intended for use as foliar sprays. Common insecticide names are followed, in parentheses, by trade names (sometimes with specific formulations). Safety, price, availability, effectiveness, etc., all should be considered when narrowing the list to the product(s) you select for use.

Rates are usually given in terms of pounds of actual insecticide toxicant per acre. A recommendation of 2 pounds of carbaryl per acre thus requires: 2½ pounds of 80 percent Seven S per acre; or 4 pounds of 50 percent Sevin WP per acre.

Waiting intervals refer to the time that must elapse between application and harvest. The waiting interval in no way signifies how long the insecticide will remain active in controlling insects. Re-entry intervals specify the minimum time period that special protective gear (specified on the label) must be worn when the field is entered after treatment.

Insecticide Use Classification

Growers must be certified by the Kansas Department of Agriculture before RESTRICTED USE PESTICIDES can be legally purchased or used. General use pesticides can be purchased or used by anyone; however, commercial applicators must obtain a business license in order to apply ANY pesticide commercially. In addition, commercial applicators must be certified under the appropriate commercial category in order to use restricted use pesticides.

Using Insecticides Safely

ALL INSECTICIDES ARE CAPABLE OF CAUSING INJURY TO MAN AND ANIMALS. Injury or death can result from swallowing, inhalation, or skin absorption. Handle with care and use only when needed. Follow directions on the label and heed all precautions. Store in original containers, away from food products, in a dry place where children, unauthorized persons, livestock and pets are not allowed.

Avoid spilling insecticides on the skin, mucous membranes (mouth, nose, and eyes), and clothing when mixing or applying. If spilled on the body, immediately wash it off and change clothing. Wash your face and hands thoroughly after applying any insecticide—especially before eating, drinking, or smoking. if in the eyes, flush with water for 15 minutes and seek prompt medical attention. If exposed and in need of medical treatment, take the insecticide container label with you. It has valuable information the physician will need. **For poison control information call 1-800-332-6633.**

Always wear protective equipment (respirators, clothing, etc.) adequate for the risk involved, as specified on the label. Bathe and change clothing after long exposure to insecticides. Wash clothes on which insecticide residues may have accumulated before wearing them again. Be sure to wash contaminated clothing separately from other, uncontaminated clothing.

Protect fish and wildlife. Do not contaminate streams, lakes, ponds, or marshes. Do not clean spraying equipment or dump excess spray material near such sites. Avoid drift of sprays or dusts. Do not allow poultry, dairy animals, or meat animals to feed on plants or drink water contaminated by insecticide drift.

Avoid killing bees. Limit applications to hours when bees are not visiting the plants. Avoid drift to bee yards or adjacent blooming crops. Notify bee owners before applications are made near bee yards. In general, sprays are less harmful to bees than dusts.

Producers in Mead, Clark, Comanche, Stafford, Reno, Rice and Barton counties should be aware of the endangered species protection program established by the EPA in their counties. They can contact their local county Extension office for more information.

The mention of commercial products in this publication does not imply its approval to the exclusion of other products that also may be suitable. REMEMBER: THE LABEL CARRIES THE FORCE OF LAW! FOLLOW ALL INSTRUCTIONS CAREFULLY.

Sunflowers and Insects in Kansas

Cultivated sunflowers in Kansas host a wide variety of insects. Most are not damaging and the injurious species are not always present in densities capable of causing economic loss. When significant damage does occur, it may result from leaf, stem, root, flower, and (or) seed feeding.

Several species of native sunflowers may serve as wild hosts. Many sunflower insects overwinter in or near sunflower plant residue. Crop rotation, modified planting dates, control of wild sunflowers, or deep plowing may reduce the economical importance of later infestations. Experience has shown that the judicious use of insecticides is often required for successful sunflower production in Kansas.

Note on Ethyl Parathion:

Note: Restrictions apply to ethyl parathion use including aerial application by certified commercial applicators only; use of closed transfer systems of mixing/loading operations; mechanical harvesting of crops; buffer zones around water, public roadways, buildings, and property lines; re-entry restrictions limiting scouting and irrigation worker access; and inadvertent incident reporting requirements. Special storage requirements also are being implemented and EPA has indicated that an 'intent to cancel the remaining uses' will likely be issued in the near future.

Cutworms

Several species of cutworms, including dingy, dark-sided, sandhill, and black are known to damage young sunflowers at or soon after emergence. Small, transparent 'windows' appearing in young leaves may be caused by very small larvae not yet capable of feeding entirely through the leaf. Notches in the leaves or cotyledons may suddenly appear if sunflowers are planted into fields with existing infestations. Older larvae inflict less subtle damage in the form of wilted, severed (cut), and dying seedlings. Excessively cool, wet soils tend to enhance the degree of stand reduction by slowing plant development relative to pest feeding.

Larger larvae of most cutworms feed nocturnally and remain concealed during the day, staying within a few inches of damaged plants. The discovery of cut plants and one or more larva per square foot warrants rescue applications of insecticides if the majority of the larvae have not pupated. Insecticides should be applied if larvae cause plant stands to decline below 85 percent of recommended levels and many larvae are less than 1½ inches long. Dry soil conditions will greatly reduce the probability of achieving acceptable control by spraying.

Stem Weevils*

At least two species of stem weevils of economic importance in other states may damage sunflowers in Kansas. Probably the most important of these weevils is ⅛ to 3⁄16 inches long and is mottled in coloration. Several irregular white spots occur on the upper body of these largely gray–brown adults. The antennae, snout, and eyes are black. The other common stem weevil has a short, blunt snout, a robust, oval body (¼ inch long), and is dull black in color. Adults may feed on the foliage but only larvae cause economic damage. Egg laying begins about two weeks after adults emerge.

Weevils of the mottled species may insert up to 20 eggs per plant in the lower one-third of the stem over two weeks. Young larvae feed just beneath the stem surface. Larger larvae (still only ¼ inch long) migrate to the pith tissue where heaviest feeding occurs. By late summer, most larvae have burrowed down to near the soil surface, constructing a large overwintering chamber in the lower stem. Pupation occurs the following spring or early summer.

Adults of the black species usually emerge soon after the mottled weevil, and may be found feeding on sunflower foliage early in the morning or late in the evening. Within two weeks, adults migrate down near the root zone. Eggs are deposited (in groups of 2 or 3) beneath callous tissue around adult feeding scars. Larvae feed and develop without moving far within the stem, overwintering among the decaying roots.

Several larvae per plant are required by either species to cause significant damage. When large populations develop (25 or more per stalk), yields may be depressed through physiological stress and harvest (lodging) losses.* Severe feeding damage can disrupt the flow of water and nutrients, causing unthrifty plants, delaying development, dwarfed heads with a lower oil content per seed. Drought stress or high winds aggravates the amount of lodging caused by the weakening of the lower stalks. Late-season lodging caused by disease or by stem girdlers can be mistaken for stem weevil damage.

Non-rotated, early planted fields (planted before mid-June) seem to have the greatest likelihood of damage. Very late planted or double crop sunflowers seldom develop severe stem weevil infestations. Systemic, planting time treatments (some carbofuran formulations) or foliar sprays (intended as adult controls) may be available. North Dakota recommends control where 1 adult per 3 plants are found during late June or early July. Kansas recommendations historically have noted that foliar treatments may be justified where 2 to 4 weevils per plant are detected.

Note: Foliar insecticides may not give the protection desired. Plants sampled should be approached slowly because disturbed stem weevils readily drop to the soil. Adults emerge from May through early July.

**Also see stem girdlers. Lodging may be caused by stem weevils, stem girdlers, or by vertebrates such as skunks and raccoons foraging for grubs.*

Sunflower Moth (Commonly Referred to as 'Head Moth')

Adults are buff to grayish moths with a ¾ inch wing span and ⅜ inch long body. Other moths are attracted to sunflowers, so be wary of misidentifications. When at rest, sunflower moth wings are tightly clasped to the body (cigar-shaped). A couple of pinpoint (dark) spots, near the center of the leading edge on the front wings, may be evident (depending upon moth condition).

Adult sunflower moths prefer plants in early stages of bloom for egg laying purposes. Nearly 80 percent of the eggs are deposited within 4 to 7 days after the bud begins

opening. Eggs usually hatch in 2 or 3 days. Newly hatched larvae are yellowish in color. Four cream to yellowish-green longitudinal stripes rapidly develop on the now largely purplish brown or maroon larvae. Maximum length will approach ¾ inch.

For the first 4 to 5 days after hatching young larvae feed on pollen and florets on the flower surface. Once larvae enter the heads, significant seed damage may result. During the subsequent 2 to 2½ weeks, a larva may tunnel into and destroy a dozen or more developing seeds. Some larvae never actually enter a seed but still contribute substantially to yield loss by consuming floret parts necessary for pollen reception and fertilization (stigma and style). Early damage may result in floret death or 'pops' (unfilled seed hulls). However, seed filling will usually continue unaffected if stigma and style are not damaged until after fertilization is completed. Tangled mats of silken webbing, soiled by excrement and floral debris, are left as larvae move about in and on the head. Sunflowers attacked by the sunflower moth larvae are also more susceptible to infection by Rhizopus head rot. After feeding is completed, a majority of larvae drop to the soil on silken threads and either diapause or pupate 3 to 4 inches below the surface.

Sunflower moth larvae feeding within the head proper cannot be controlled effectively with insecticides. Therefore, sprays should be timed to coincide with the surface feeding stages. Unfortunately, sampling directly for these tiny larvae is not really practical.

In practice, most researchers recommend treatment guidelines based on adult surveys rather than larval counts. Several heads (yellow ray petals visible) should be routinely examined every 2 days for sunflower moth adults in the early morning or late evening throughout bloom (until pollen shed is complete). Relatively calm mornings or evenings are preferred for accurate sampling. Some researchers recommend treatment if ANY adults are found. Others, particularly from the more northern sunflower production states, stipulate that 2 moths per 5 heads should be present before most treatments can be economically justified. Yield loss averaged 8.8 pounds per acre based on 1 larvae per head in Kansas research trials.

Pheromone traps that lure and capture adult male moths with a synthetic attractant which mimics odors released by receptive female sunflower moths are available through private firms to help pinpoint moth activity periods. This information is helpful in allocating scouting efforts.

Researchers in Kansas, Colorado, and Nebraska have been studying the relationship between pheromone trap catches of adults and head infestations composed of sunflower moth and banded sunflower moth larvae. During 1986 and 1987, a Kansas study concluded that pheromone traps could be an efficient asset for determining if moths are active in production fields. A significant relationship between numbers of larvae per sunflower head was found in 2 of 3 years in fields within 1 week of bloom initiation. Traps had value for monitoring sunflower moth from 1 week prior to bloom initiation until 1 week after full bloom. The relationship did not hold during 1988, an unusually hot and dry year, however. Briefly, this Kansas research indicated that if a weekly average of 29 sunflower moths were captured per pheromone trap, foliar treatment of oil seed sunflowers might be economically justified. That is, if more than 4 sunflower moths/head/day are captured then heads will usually contain many larvae and suffer extensive damage. Infestations usually remain low when traps are capturing less than one sunflower moth/trap/day. Predictions of larval populations in heads were not conclusive where between 1 and 4 sunflower moths/trap/day were collected. Occasionally, traps placed on the south end of fields collected more adults than traps placed on the north end.

If treatment becomes necessary, the first spray of a multiple spray schedule should be applied as the field enters early bloom. Recommended spray dates seem to be moving earlier, with many producers and consultants reporting more success with treatments applied from the onset of bloom to 20 percent of plants showing yellow ray petals. Some research information indicates that 1 or 2 additional sprays will probably be necessary when moderate to high sunflower moth populations exist. These additional sprays (if permitted by the product label) should be applied at 5- to 7-day intervals if significant numbers of adults remain.

Most reports indicate that early planted fields (blooming before late July) probably stand the greatest chances of developing significant infestations. Planting in early July greatly reduced head moth infestations at several Kansas research stations located around the state during the 1986 to 1988 growing seasons. However, delayed planting does not guarantee that treatments will not become necessary and early frost, plus seed weevils may become factors reducing yield potential.

These planting date studies were conducted at Belleville, Hays, Hesston, Hutchinson, and Manhattan to assess likelihood of sunflower moth infestations developing. Greater numbers of sunflower moth larvae and a greater percentage of each head were damaged with early (mid-May or early June) than later (early July) plantings. Location made some difference, with Belleville and Hays plantings having less damage when the crop was planted after the second week in June; however, at Hesston, Hutchinson, and Manhattan, reduced numbers of larvae were only associated with the early July plantings.

Highest net returns occurred where insecticide treatments were applied. Greatest return resulted when the crop was planted during the first week of June at Hesston, and the first week of July at Hutchinson if the insecticide was effective. However, if no insecticide was used, maximum net return was obtained by planting during the second or third week of June at Belleville, Hesston, and Manhattan, and by planting during the first week of July at Hutchinson.

Seed Weevils

At least two species of seed weevil (snout beetles) have caused yield reductions. One species is reddish-brown and about ⅛ inch long, whereas the larger seed weevil is gray and approaches ¼ inch. Adults initially cause insignificant damage by feeding on the stem, leaf petioles, and beneath the bracts on the buds. Pollen becomes the preferred adult food during anthesis (pollen shed). Female weevils of both species insert an egg (occasionally more than one) directly into the developing seed. Egg laying begins in seeds at the outer edge of the head and progresses inward following seed development. Hatching occurs in about a week and the larvae feed internally until fully grown. After feeding stops, the majority of the larvae cut exit openings through the seed coat and drop to the soil to overwinter. Larvae emerging in storage will die

without causing further damage to stored sunflowers. Pupae form the next year by early summer and give rise to adults which repeat the annual cycle.

Insecticides, when necessary, must be directed against adults because of the protection larvae derive by feeding internally. In fields nearing 85 percent bloom, 5 sets of 5 plants (away from field margins) should be fully examined for seed weevils. If populations on oil seed varieties reach 14 to 15 adults per plant and the necessary insecticides can be obtained for under $3.00 per acre (excluding application cost), the treatment is probably economically justified. However, if the cost for registered insecticides approach $6.50 per acre, populations of 22 to 25 seed weevil adults per head would be required to recover treatment costs. These figures are based on anticipated yields of 1,300 to 1,500 pounds per acre and a market value of 8¢ per pound. The economic threshold drops to only 1 adult per head when confectionery varieties are considered. Sprays for sunflower moth may assist in suppressing seed weevil populations. Better spray coverage will result if treatments are applied before head droop.

Pollinators

Hybrid sunflowers are largely self-fertile, therefore are less dependent upon insect pollination than were open-pollinated varieties. However, some reports indicate that seed yield may be enhanced by pollinators. Since most of the insecticides labeled on sunflowers are highly toxic to bees, pest control programs should always be conducted so that these beneficial insects are protected. Mortality to honey bees and other insect pollinators should be reduced (but not necessarily eliminated) if spray applications are restricted to very early in the morning or late in the evening. Insecticides should not be applied to sunflowers in bloom until area beekeepers have been informed and bees have been removed from the area.

Insects Attacking Sunflower Seeds in Storage

Most common stored grain insects will survive and reproduce on sunflower seeds. Therefore, structures having active populations of these insects should not be used for sunflower storage. Additionally, sound postharvest management involves the storing of low moisture seed, proper use of aeration, and monthly inspections for insects and elevated subsurface temperatures. Verify legality of all products before applying to stored sunflowers. Bacillus thuringiensis, marketed under Dipel® and other tradenames, is an insect pathogen approved for use against Indian meal moth larvae. Recommended rates should be applied and thoroughly incorporated into the surface 4 to 6 inches of the seed mass. Currently, aluminum phosphide is the only fumigant cleared for use on stored sunflowers.

What is the Worker Protection Standard?

The Worker Protection Standard (WPS) is a new series of federal regulations pertaining to pesticides used in agricultural plant production on farms, forests, nurseries, and greenhouses. You must comply with these new regulations (as they appear on product labels beginning in 1994) if you are an agricultural pesticide user and/or an employer of agricultural workers or pesticide handlers. For more complete information, consult the EPA Publication, "The Worker Protection Standard for Agricultural Pesticides—How to Comply, What Employers Need to Know." Copies are available at your local county Extension office.

Additional Insects Causing Concern in Kansas Sunflowers

Additional Sunflower insects	Description	Damage and Importance
Banded sunflower moth	Adult: Straw-colored forewings marked with dark brown. Larva: Body is less than ½ inch long and off-white, pink, or green in color. The head capsule is dark brown.	Larvae generally appear about 1 week after sunflower moth larvae. Larvae usually found feeding on seed and florets in the central portion of the head. Some recommendations from other states suggest treating if one banded sunflower moth is observed per two plants. Although large numbers of banded sunflower moth adults are frequently caught in pheromone traps, few banded sunflower moth larvae are usually found in the heads, making pheromone traps unsuitable for decision-making.
Carrot beetles	Adults are ½ to ¾ inch long, stout, reddish-brown beetles that strongly resemble May beetles. Wing covers have pits arranged in lines and the lower part of the leg-bearing region (thorax) is very hairy.	Second-brood adults feed to 1 to 5 inches below the surface on sunflower roots usually in late July or early August. Large infestations cause stunting, wilting, and lodging. Insect feeding mammals may cause further root damage. No controls available.

Additional Insects Causing Concern in Kansas Sunflowers

Additional Sunflower insects	Description	Damage and Importance
General leaf feeders **Painted lady, woolly bear, spotted cabbage looper and grasshopper**	Larva: Variously marked foliage-feeding caterpillars. Grasshoppers: Nymphs or adults	Limited defoliation is caused by one or more species in most fields. Only rarely does damage become severe enough to justify field-wide controls. Insecticides may be warranted if the defoliation reaches 25% during bloom and larvae have not yet begun to pupate. Grasshopper populations should not be permitted to exceed 8 per square yard.
Head-clipper weevil	Adult: Adult weevils are about ¼ inch long, black, with a curved snout. Under magnification adults appear pitted and somewhat hairy.	Adults begin to appear in mid-summer. Stalk feeding occurs just below heads, resulting in head drop. Damage is dramatic but rarely involves a significant percentage of plants.
Soldier beetles and blister beetles	Adults are elongate, soft-bodied beetles which superficially resemble lightning bugs. Common species are yellow and black or solid bronze.	Adults are largely pollen and nectar feeders. Pollination may be enhanced by their activities. No controls are necessary.
Stem girdlers or Long-horned beetles	Adults: Several elongate, hard-shelled beetles adorned with very long antennae. Larva: Elongate, cylindrical, whitish, legless or with only rudimentary legs. Mature larvae are greater than 1 inch in length.	Depending on species, adults lay eggs near girdled areas of the upper stem or on lower leaf petioles. Larvae continue to weaken the stem as they feed internally. Heads may drop or stalks lodge. Lodging appears to be most severe on early planted sunflowers. Incidence may be increasing in northwest Kansas. No controls are available.
Sunflower Beetle	Adult: Slightly smaller but very similar in shape to Colorado potato beetle. Alternate light yellow background with dark brown stripes occurring on the wing covers. Larva: Yellowish, hump-backed.	Occur in Late May and early June. Both adults and larvae chew holes in leaves. Economic damage rare in Kansas. Treat if 1 adult is present per seedling or larvae reach 10–15/plant on upper leaves, 25% defoliation occurs, and pupation has not begun.
Sunflower bud moth	Adult: Slightly gray moth with black transverse bands on the wing. Larva: Yellow–brown head with a pale-white to yellowish body approximately ¾ inch long at maturity.	Injury usually confined to stalk or fleshy portion of head. Entry is commonly marked by black frass, especially at leaf axils. Head and stalk deformation may occur but yield loss is usually insignificant.
Sunflower maggots (several species)	Adult: Small flies with patterned or mottled wings. Larva: Typical fly maggots, dirty white and tapering from front to rear.	The most common sunflower maggot feeds in the stalk, causing weakening and stalk breakage. Other species may feed in the receptacle, head, or stalk.
Sunflower midge	Adult: Small (⅛ inch), dark, gnat-like insect. Larva: cream or yellowish color, ⅛ inch long, tapered at front and rear.	Adults lay eggs on heads 1 to 2 inches in diameter. Larvae feed in ray petal area and on base of seeds (especially near center of head). Shrinkage and distortion of heads and seeds result.

Insecticides Approved for Application on Sunflowers[a]

Insects	Insecticide	Rate	Special Instructions
Banded sunflower moth	Cyfluthrin (Baythroid 2)[b]	0.031 to 0.044 lb. a.i./a (2.0 to 2.8 fl. oz./a)	A total of 0.132 lb. a.i./a (8.4 fl.oz.) may be applied per season. 30 day pre-harvest interval.
	Esfenvalerate (Asana XL)[b]	0.03 to 0.05 lb. a.i./a (5.8 to 9.6 fl. oz./a)	Repeat as necessary to maintain control. Do not exceed 0.2 lb. a.i./a per season. 28-day preharvest waiting interval.
Cutworms	Chlorpyrifos (Lorsban 4E)	1 to 1½ lb. a.i./a (2 to 3 pt.)	Broadcast spray by air or ground equipment. Two treatments at 7- to 10-day intervals are permitted. 42-day preharvest restriction. Do not graze or feed treated forage.
	Esfenvalerate (Asana XL)[b]	0.03 to 0.05 lb. a.i./a (5.8 to 9.6 fl. oz./a)	Repeat as necessary to maintain control. Do not exceed 0.2 a.i./a per season. 28-day preharvest waiting interval.
	Lambda-cyhalothrin (Warrior T)[b]	0.01 to 0.02 lb. a.i./a (1.28 to 2.56 fl.oz./a	Apply by ground or air in sufficient gallonage to obtain full coverage. Use a minimum of 2 gal. of water per acre by air. Do not apply more than 0.12 lb. a.i. (0.96 pt.) per acre per season and do not apply more than 0.09 lb. a.i. (0.72 pt.) per acre per season after bloom initiation. Do not apply within 45 days of harvest.
	Cyfluthrin (Baythroid 2)[b]	0.0125 to 0.025 lb. a.i./a (0.8 to 1.6 fl. oz./a)	A total of 0.132 lb. a.i./a (8.4 fl.oz.) may be applied per season. 30 day pre-harvest interval.
Grasshoppers	Carbofuran (Furadan 4F)[b]	⅛ to ½ lb. a.i./a (4 to 16 fl. oz.)	Follow 'special instructions' under stem weevils. Foliar spray.
	Chlorpyrifos (Lorsban 4E)	½ lb. a.i./a (1 pt.)	42-day preharvest restriction. Do not graze or feed treated forage.
	Esfenvalerate (Asana XL)[b]	0.03 to 0.05 lb. a.i./a (5.8 to 9.6 fl. oz./a)	Repeat as necessary to maintain control. Do not exceed 0.2 lb. a.i./a per season. 28-day preharvest waiting interval.
	Lambda-cyhalothrin (Warrior T)[b]	0.02 to 0.03 lb. a.i./a (2.56 to 3.84 fl.oz./a)	Follow 'special instructions' under stem weevils.
	Cyfluthrin (Baythroid 2)[b]	0.031 to 0.044 lb. a.i./a (2.0 to 2.8 fl. oz./a)	A total of 0.132 lb. a.i./a (8.4 fl.oz.) may be applied per season. 30 day pre-harvest interval.
Loopers	*Bacillus thuringiensis* (Dipel and other labeled products)	See label	Larvae must be actively feeding. Only effective against certain caterpillars. No preharvest restriction. No use restriction.
Seed weevils	Chlorpyrifos (Lorsban 4E)	½ to ¾ lb. a.i./a (1 to 1½ pt.)	42-day preharvest restriction. Do not graze or feed treated forage.
	Cyfluthrin (Baythroid 2)[b]	0.031 to 0.044 lb. a.i./a (2.0 to 2.8 fl. oz./a)	A total of 0.132 lb. a.i./a (8.4 fl.oz.) may be applied per season. 30 day pre-harvest interval.
	Esfenvalerate (Asana XL)[b]	0.03 to 0.05 lb. a.i./a (5.8 to 9.6 fl. oz./a)	Repeat as necessary to maintain control. Do not exceed 0.2 lb. a.i./a per season. 28-day preharvest waiting interval.
	Lambda-cyhalothrin (Warrior T)[b]	0.02 to 0.03 lb. a.i./a (2.56 to 3.84 fl.oz./a)	Follow 'special instructions' under stem weevils.
	Parathion, methyl[b]	1 lb. a.i./a	Up to 3 applications at 5-day intervals are permitted. 30-day preharvest restriction. Do not feed seeds to birds.

Insects	Insecticide	Rate	Special Instructions
Stem weevils	Carbofuran (Furadan 4F)[b]	2.5 fluid oz. per 1000 ft. or row	At planting. Apply directly into the seed furrow. Observe all precautions listed on the label.
		½ lb. a.i./a (1 pt)	Foliar spray (Up to 4 applications per season). Minimum 2 gal. Finished spray per acre by air and 10 gal. by ground. Do not re-enter treated field within 14 days without proper protective clothing. Do not harvest within 28 days of last application. Apply prior to bloom.
	Chlorpyrifos (Lorsban 4E)	½ to ¾ lb. a.i./a (1 to 1½ pt.)	42-day preharvest restriction. Do not graze or feed treated forage.
	Esfenvalerate (Asana XL)[b]	0.03 to 0.05 lb. a.i./a (5.8 to 9.6 fl. oz./a)	Repeat as necessary to maintain control. Do not exceed 0.2 lb. a.i./a per season. 28-day preharvest waiting interval.
	Lambda-cyhalothrin (Warrior T)[b]	0.02 to 0.03 lb. a.i./a (2.56 to 3.84 fl.oz./a)	Apply by ground or air in sufficient gallonage to obtain full coverage. Use a minimum of 2 gal. of water per acre by air. Do not apply more than 0.12. lb. a.i. (0.96 pt.) per acre per season and do not apply more than 0.09 lb. a.i. (0.72 pt.) per acre per season after bloom initiation. Do not apply within 45 days of harvest.
	Cyfluthrin (Baythroid 2)[b]	0.025 to 0.0375 lb. a.i./a (1.6 to 2.4 fl. oz./a)	A total of 0.132 lb. a.i./a (8.4 fl.oz.) may be applied per season. 30 day pre-harvest interval.
Sunflower beetle	Carbaryl (Sevin XLR 80S, 50W or 4F)	1 to 2 lb. a.i./a	60-day preharvest interval. Do not graze treated areas.
	Carbofuran[b] (Furadan 4F)	⅛ to ¼ lb. a.i./a (4 to 8 fl. oz.)	Follow 'special instructions' under stem weevils. Foliar spray.
	Cyfluthrin (Baythroid 2)[b]	0.0125 to 0.025 a.i./a (0.8 to 1.6 fl. oz./a)	A total of 0.132 lb. a.i./a (8.4 fl.oz.) may be applied per season. 30 day pre-harvest interval.
	Esfenvalerate (Asana XL)[b]	0.015 to 0.03 lb. a.i./a (2.9 to 5.8 fl. oz./a)	Repeat as necessary to maintain control. Do not exceed 0.2 a.i./a per season. 28-day preharvest waiting interval.
	Lambda-cyhalothrin (Warrior T)[b]	0.01 to 0.02 lb. a.i./a (1.28 to 2.56 fl.oz./a)	Follow 'special instructions' under stem weevils.
Sunflower maggots	Esfenvalerate (Asana XL)[b]	0.03 to 0.05 lb. a.i./a (5.8 to 9.6 fl. oz./a)	Repeat as necessary to maintain control. Do not exceed 0.2 lb. a.i./a per season. 28-day preharvest waiting interval.
	Parathion, methyl[b]	1 lb. a.i./a	Up to 3 applications at 5-day intervals are permitted. 30-day preharvest restriction. Do not feed seeds to birds.
Sunflower moth	Chlorpyrifos (Lorsban 4E)	½ to ¾ lb. a.i./a (1 to 1½ pt.)	Two treatments are permitted at 7-day intervals. 42-day preharvest restriction. Do not graze or feed treated forage.
	Cyfluthrin (Baythroid 2)[b]	0.031 to 0.044 lb. a.i./a (2.0 to 2.8 fl. oz./a)	A total of 0.132 lb. a.i./a (8.4 fl.oz.) may be applied per season. 30 day pre-harvest interval.
	Endosulfan (Thiodan)	1 lb. a.i./a	Up to 3 applications are permitted. Multiple treatments may follow at 7-day intervals, if needed. Do not feed treated forage to livestock.

Insects	Insecticide	Rate	Special Instructions
Sunflower moth cont.	Esfenvalerate (Asana XL)[b]	0.03 to 0.05 lb. a.i./a (5.8 to 9.6 fl. oz./a)	Repeat as necessary to maintain control. Do not exceed 0.2 lb. a.i./a per season. 28-day preharvest waiting interval.
	Lambda-cyhalothrin (Warrior T)[b]	0.02 to 0.03 lb. a.i./a (2.56 to 3.84 fl.oz./a)	Follow 'special instructions' under stem weevils.
	Parathion, ethyl [b,c]	½ to 1 lb. a.i./a	**See notes on page 2 regarding ethyl parathion before using.** Up to 3 applications at 5-day intervals are permitted. 30-day preharvest restriction.
	Parathion, methyl[b]	1 lb. a.i./a	Up to 3 applications at 5-day intervals are permitted. 30-day preharvest restriction. Do not feed seeds to birds.
Woolybear caterpillars	Lambda-cyhalothrin (Warrior T)[b]	0.02 to 0.03 lb. a.i./a (2.56 to 3.84 fl.oz/a)	Follow 'special instructions' under stem weevils.

aObserve specific label guidelines. Most treatments are designed for use with conventional ground or aerial equipment. Relatively few products are clearly labeled for use through overhead sprinkler irrigation systems.
bRestricted use pesticide.
cControl of sunflower moth with parathion has been erratic in Kansas research tests. Also see note about Parathion on page 2.

Phillip E. Sloderbeck
Extension Specialist
Entomology, Southwest

Randall A. Higgins
Extension State Leader
Entomology

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

MF-814 (Revised) February 2001

File Code:Entomology—2 2-98—5M